

#### **Bowman Lab**

Yasin Ahmed Kaylan Schilling Jacob Guidry Geetu Babu Steven Poyer Tyler Smith



Nik Mushnikov Jacob Guidry





#### **Basic Science: Anatomy of Bacteria**



#### **Polar asymmetry -> multicellularity**

#### **Basic Science: A molecular sieve at cell poles**



#### **Basic Science: A molecular sieve at cell poles**



Structure: Krisztina Varga, University of New Hampshire Flexible "nose" binds to multiple other proteins

#### **Applied Science: Programmable Multicellularity**



> C. crescentus divides asymmetrically> "Multicellular"



> E. coli divides symmetrically
"Unicellular"

#### **Applied Science: Programmable Multicellularity**



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Transplant PopZ: *E. coli* now divides asymmetrically

### **Applied Science: Programmable Multicellularity**

#### With Mark Gomelsky (Molecular Biology)



Genetic Engineering: *E. coli* + 3 genes -> multicellularity



US Patent Application 2019/0322980 A1 ...moved toward allowance 4/5/2022



With Microbial "Stem Cells"

> continual production by new "factory cells"

### **Education Research: Augmented Reality in Social Learning Environments**

With Jon Prather (Zoology & Physiology) and Alan Buss (School of Teacher Education)



### Freshwater Ecosystem Ecology at UW



College of Arts and Sciences Zoology and Physiology

## Sarah Collins Assistant Professor Zoology & Physiology







How do surrounding landscapes influence lakes and streams?

How can we maintain enough high quality water in the Western US in the future?









Dr. Bella Oleksy

Dr. Carolina Barbosa



Dr. Benjamin Tumolo





Casey Brucker









Linnea Rock PhD Student



Dr. Bella Oleksy







Dr. Bella Oleksy



Dr. Carolina Barbosa





Dr. Carolina Barbosa





Dr. Ben Tumolo Postdoc











Casey Brucker Database Technician

Linnea Rock PhD Student



















**MS Student** 



Ashleigh Pilkerton

PhD Student

Are harmful algal blooms actually becoming more frequent in WY Reservoirs?

What are the implications for humans, fisheries, livestock, etc.?



Harmful Algal Bloom (HAB) advisories posted in Wyoming over the past 4 years



65% of lakes are not changing

#### 15% are improving

7% are worsening



Kelsey Ruehling, MS Student



Dr. Bledar Bisha, UW Animal







Karen Jorgenson, MS Student

Chance Roberts, MS Student







# College of Arts and Sciences Department of Botany



## Ecosystem Response to Global Change



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Understand how ecosystems are responding to current global change

Predict ecological diversity and stability under future conditions

Successfully restore ecosystems



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Undergraduate Researchers











Postdocs



















Undergraduate Researchers Mentorship PhD Students Peer-to-peer learning

Postdocs

Inclusive

## Our Scientific Approach







Data science + synthesis interface: How can we maximize restoration efforts in inherently variable ecosystems?



Experimental tests: How can we maximize restoration efforts in inherently variable ecosystems?



Synthesis + experimental interface: How can we restore native diversity after agricultural lands have been abandoned?



Modeling + experimental Interface; Wyoming + Colorado Collaboration How will fragile, alpine ecosystems respond to increased warming and more variable snow?

## Benefits of UW's Research Mission

#### **Research-based education**







## Benefits of UW's Research Mission

**Research-based education** 

Computational and data-science training

Prepare students for the complexities of an interdependent world

Benefits to the state: conservation, restoration, rangeland stability

Beyond Wyoming: key collaborators in reaching national & international goals



#### Genetic mechanisms of plant adaptation

Cynthia Weinig Professor Departments of Botany and Molecular Biology Wyoming Excellence Chair





Q: What do these 4 things have in common? A: They host millions-trillions of microorganisms (Organisms that cannot be seen with the naked eye).



National Science Foundation EPSCoR Track I award : Linking microbial life to ecosystem services across Wyoming's dynamic landscape



Basic Research: Statewide sampling of microbial communities to date, 2017-2020.

Additional sampling 2021, 2022, 2023



Basic research : Some plants alter the chemistry of soil around their roots in a way that affects local microbes. Soil microbes can increase plant defense responses to insect pests.



Applied : Can we transplant microbes and improve plant defense responses?



# How does the presence vs absence of water lilies affect aquatic chemistry and microbial composition?



The preceding project on plant-microbe-insect interactions was completed over 4 yrs by Ella DeWolf as a WY Research Scholar, DeWolf et al., *Molecular Ecology* in review.

Our first water lily project was completed by Ella DeWolf as a graduate student on the WY EPSCoR Track I project, DeWolf et al. *Frontiers in Microbiology* 2022.

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#### Value of the research mission



- Large awards from the NSF like the Track I are interdisciplinary, and integrative research by definition involves computational training
- Most external research requires "broader impacts" enabling statewide outreach, improvement in diversity, entrepreneurship
- External funding to faculty provides unique and high-quality research opportunities to students
- External funding to faculty improves the in-class learning environment because research-active faculty know what is at the cutting edge of a discipline